COMMONWEALTH OF KENTUCKY
NATURAL RESOURCES & ENVIRONMENTAL PROTECTION CABINET
DEPARTMENT FOR ENVIRNOMENTAL PROTECTION
DIVISION OF WATER

APPLICATION FOR PERMIT TO CONSTRUCT ACROSS OR ALONG A STREAM AND / OR WATER QUALITY CERTIFICATION

Chapter 151 of the Kentucky Revised Statutes requires approval from the Division of Water prior to any construction or other activity in or along a stream that could in any way obstruct flood flows or adversely impact water quality. *If the project involves work in a stream, such as bank stabilization, dredging or relocation, you will also need to obtain a 401 Water Quality Certification (WQC) from the Division of Water.* This completed form will be forwarded to the Water Quality Branch for WQC processing. The project may not start until all necessary approvals are received from the KDOW. For questions concerning the WQC process, contact the WQC section at 502/564-3410.

If the project will disturb more than 1 acre of soil, you will also need to complete the attached Notice of Intent for Storm Water Discharges, and return both forms to the Floodplain management Section of the KDOW. This general permit will require you to create an implement an erosion control plan for the project.

1. **OWNER:** Ron Brooks /, **KY DEPT. OF FISH AND WILDLIFE RESOURCES**
   Give name of person(s), company, governmental unit, or other owner of proposed project.
   MAILING ADDRESS: #1 SPORTSMAN'S LANE
   FRANKFORT, KY 40601
   TELEPHONE #: (502) 564-7109 ext. 4466 **EMAIL:** ron.brooks@ky.gov

2. **AGENT: BRIAN J. BELCHER, PHD, PE**
   Give name of person(s) submitting application, if other than owner
   ADDRESS: 106 MISSION COURT, SUITE 101B, FRANKLIN, TN 37067
   TELEPHONE #: (615) 794-7771 EMAIL: brian@beavercreekhydrology.com

   RECEIVED
   AUG 5 2009
   WATER QUALITY BRANCH

3. **ENGINEER: BRIAN J. BELCHER P.E. NUMBER: 21501**
   Contact Division of Water if waiver can be granted.
   TELEPHONE #: (615) 794-7771 EMAIL: brian@beavercreekhydrology.com

4. **DESCRIPTION OF CONSTRUCTION: KY IN-LIEU FEE STREAM MITIGATION PROJECT**
   Describe the type and purpose of construction and describe stream impact
   THIS PROJECT CONSISTS OF STREAM RESTORATION AND ENCHANCEMENT USING NATIVE MATERIALS AND BALANCED CUT/FILL FOR RESHAPING A SINUOUS B4 STREAMTYPE, APPROX. 14.5' WIDE, INSTALATION OF ONE LOW-WATER FORD, GRADE CONTROL STRUCTURES, HABITAT STRUCTURES AND NATIVE RIPARIAN CORRIDOR.

5. **COUNTY: KNOX NEAREST COMMUNITY: LONDON**

6. **USGS QUAD NAME HIMA LATITUDE/LONGITUDE: 37.01017N; 83.87247 W**

7. **STREAM NAME: CRANES NEST BRANCH WATERSHED SIZE (in acres): 237**

8. **LINEAR FEET OF STREAM IMPACTED: 2,275 L.F.**

9. **DIRECTIONS TO SITE: FROM I-75 EXIT 38 (LONDON) TRAVEL EAST ON STATE ROUTE 192; TURN RIGHT ON ROUTE 229 SOUTH; TRAVEL ~12 MI. AND TURN LEFT ON ROUTE 1304; TRAVEL ~ 3.5 MI. AND TURN LEFT ON ROUTE 1803; TRAVEL ~1.4 MI. NORTH AND TURN RIGHT ON CRANE'S NEST BRANCH ROAD. THE PROJECT IS AT THE END OF CRANE'S NEST BRANCH ROAD.**

10. **IS ANY PORTION OF THE REQUESTED PROJECT NOW COMPLETE?** ☐ Yes X No If yes, identify the completed portion on the drawings you submit and indicate the date activity was completed. DATE: _____

11. **ESTIMATED BEGIN CONSTRUCTION DATE: _OCTOBER 1, 2009**

12. **ESTIMATED END CONSTRUCTION DATE: _NOVEMBER 30, 2009**

13. **HAS A PERMIT BEEN RECEIVED FROM THE US ARMY, CORPS of ENGINEERS?** ☐ Yes X No If yes, attach a copy of that permit.

14. **THE APPLICANT *MUST* ADDRESS PUBLIC NOTICE:**

(a) PUBLIC NOTICE HAS BEEN GIVEN FOR THIS PROPOSAL BY THE FOLLOWING MEANS:

____ **Public notice in newspaper having greatest circulation in area** (provide newspaper clipping or affidavit)

____ **Adjacent property owner(s) affidavits** (Contact Division of Water for requirements.)

(b) _X I REQUEST WAIVER OF PUBLIC NOTICE BECAUSE:

__NATIONWIDE PERMIT 27 AND KY ILF PROGRAM PROJECT

Contact Division of Water for requirements.

15. **I HAVE CONTACTED THE FOLLOWING CITY OR COUNTY OFFICIALS CONCERNING THIS PROJECT:**

_____

Give name and title of person(s) contacted and provide copy of any approval city or county may have issued.

_____

16. **LIST OF ATTACHMENTS:** _____

List plans, profiles, or other drawings and data submitted. Attach a copy of a 7.5 minute USGS topographic map clearly showing the project location.

__ATTACHMENT A: CONSTRUCTION DRAWINGS_____

__ATTACHMENT B: Phase A Report– 660-C40L-CN01-00 (ENGINEERING REPORT) _____

_____

_____

17. **I, _X_ (owner) CERTIFY THAT THE OWNER OWNS OR HAS EASEMENT RIGHTS ON ALL PROPERTY ON WHICH THIS PROJECT WILL BE LOCATED OR ON WHICH RELATED CONSTRUCTION WILL OCCUR** (for dams, this includes the area that would be impounded during the design flood).

18. **REMARKS:** _____

_____

_____

_____

I hereby request approval for construction across or along a stream as described in this application and any accompanying documents. To the best of my knowledge, all the information provided is true and correct.

SIGNATURE: _____

Owner or Agent sign here. (If signed by Agent, a Power of Attorney should be attached.)

DATE: 8-3-09

SIGNATURE OF LOCAL FLOODPLAIN COORDINATOR:

_____

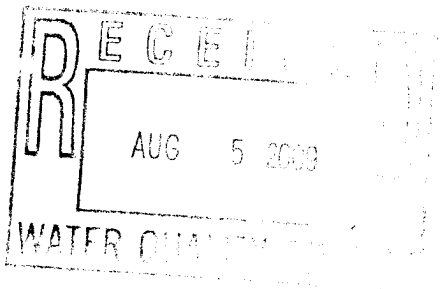
Permit application will be returned to applicant if not properly endorsed by the local floodplain coordinator.

DATE: _____

SUBMIT APPLICATION AND ATTACHMENTS TO:

Floodplain Management Section
Division of Water
14 Reilly Road
Frankfort, KY 40601

Mitigation Plan
For Cranes Nest Branch
Knox County, Kentucky



Introduction

The Kentucky Department for Fish and Wildlife Resources (KDFWR) proposes to restore approximately 2275 linear feet of existing degraded stream in Knox County, Kentucky (Exhibit 1). This project is part of KDFWR efforts in utilizing In-Lieu-Fee (FILO) Trust funds to provide stream mitigation as set forth in their 2002 agreement with the U.S. Army Corps of Engineers, Louisville District (Corps).

The stream mitigation credit (ecological lift) derived as a result of the proposed restoration activities on Cranes Nest Branch will be used to offset mitigation required for previous impacts to waters, in the Upper Cumberland River basin, for which in lieu fees were assessed.

Section 1: Goals and Objectives of the Proposed Mitigation

A. *Functions & Values*
Proposed stream mitigation include restoration of 2176 feet of existing, degraded channel into a more natural channel approximately 2275 feet in length (see accompanying stream channel mitigation plan and design sheet(s)). The focus of the restoration project is to construct a meandering stream with good in-stream habitat and stable stream banks, that conveys the bankfull discharge and sediment supplied, and has the channel-floodplain interaction to the desired recurrence interval. The current stream habitat value, using the EPA Rapid Bioassessment Protocol, is 100. The predicted stream habitat values have been provided in the Stream Success Criteria table. The predicted values represent the habitat improvement targets by which the success of the stream mitigation effort will be measured during the monitoring period. Channel morphology will be restored to lie within the central tendency of natural channels for the valley type and hydrology present, including meander pattern (sinuosity, radius of curvature, wavelength, and meander arc length), riffle-pool morphology, and section geometry (width-depth ratio, section asymmetry at pools, etc.).

The information and guidance provided in the EPA RBP was used to complete the "Habitat Assessment Field Data Sheet - High Gradient Streams" (Data Sheet) for

Cranes Nest Branch. The RBP score was compared to ranges provided by the Louisville District Corps. The pre-project Data Sheets show that Cranes Nest Branch scored relatively low and would be categorized as "marginal". The marginal habitat scores are due to channelization (straightening), has high erosion potential (incised in areas with vertical banks), and little to no forested riparian area. The predicted RBP score for the restored stream (Table 1) is in the "Excellent" range. Post-project Data Sheets will be completed as part of the final monitoring report.

B. *Functional Gains*
Stream functional gains will be determined by collecting stream habitat data using the EPA Rapid Bioassessment Protocol for the restored stream reach and compare pre-project stream habitat values to the post-project values. Stream functional gains will be credited as the net gain in functions and values, on a linear foot basis, consistent with the protocol used by the Louisville District. Estimated stream credit (ecological lift) for the site is included in Table 1.

Final stream mitigation success will be determined by the Corps and KDOW; based on site conditions at the end of the monitoring period. This information will be provided to KDFWR.

C. *Potential Challenges*
Specific to this project is the challenge of providing a design that addresses the need to stabilize the streambed and provide a channel that adequately transports the sediment load of the stream. The site is located on private property, so there is a need to address the concerns of the landowner.

The construction of stream restoration projects where channel relocation occurs in close proximity to the existing streams is inherently challenging, due to concerns over maintaining/managing current flows while minimizing excessive sedimentation and erosion. In addition to standard erosion prevention and control BMPs (e.g., silt fencing, erosion control blankets), the use of temporary diversions channels and a "pump around" may be proposed so that stream channel construction is performed "in the dry".

If a drought occurs during the construction or monitoring period, then steps will be taken to ensure proper watering of the riparian zone plantings is performed.

Sufficient remedial and contingency plans and adaptive management are incorporated in the plan to ensure that all likely challenges, such as potential effects from invasive species or stream channel instability, can be quickly addressed during the five year monitoring period. At the end of the five-year monitoring period, if mitigation is only partially successful or unsuccessful, KDFWR will submit a Contingency Plan to the Corps and KDOW or propose to extend the monitoring period beyond five years until such time as the Corps determines the project is successful. The plan or extension of monitoring will not be implemented without prior approval from the Corps and KDOW.

D. *Environmental Goals and Objectives*
The goal of this project is to restore the stream to a more natural condition by applying appropriate stream restoration principles; resulting in a stable channel that will, over time, neither aggrade or degrade.

Stream restoration on the site is expected to meet the following objectives: (a) to improve in-stream and riparian habitat; (b) to create a natural channel that is in geomorphic equilibrium and exhibits improved channel stability, and (c) to help promote hydrologic connectivity to the floodplain surrounding the restored stream channel.

Section 2: Site Selection

Refer to Phase A Report– 660-C40L-CN01-00.

Section 3: Site Protection

The site is privately owned. The KDFWR and property owners plan to jointly manage the site during the required monitoring period. KDFWR will execute a conservation easement with the owners for the mitigation site to ensure permanent protection of the property.

Section 4: Baseline Information

Refer to Phase A Report– 660-C40L-CN01-00.

Section 5: Estimated Ecological Lift

The Estimated Ecological Lift table (Table 1) indicates the benefit expected as a result of the proposed project, utilizing the Louisville District COE's Eastern Kentucky Protocol (EKP). The EKP calculates Ecological Integrity Units (EIU's) for the existing and proposed conditions of the stream; the difference indicating the resulting benefit or "ecological lift". The "Pre-project" condition and/or quality of the stream is based on assessments of the existing using EPA's Rapid Bioassessment Protocol (RBP). The results of the RBP's identify the quality of the stream; and for purposes of the EKP, its Habitat Integrity Index (HII). Utilizing this index and an indication of water quality (conductivity reading), the EKP calculates an Ecological Integrity Index (EII). Consequently, the Ecological Integrity Units are determined by applying the EII ratio to the length of the expected impact. Cranes Nest Branch, as assessed, was found to be marginal (with an RBP score of 100). The score, as applied to perennial streams, results in an EII of 0.55. The expected impact length is multiplied by the ratio to

provide a final EIU of 1197. For determining the EIU's resulting from the project, a similar approach is used, with the exception being an assumed RBP score based on expected final project results. In the cast of Cranes Nest Branch, the goal of the mitigation project is to achieve a RBP score of 171 or higher; resulting in an "optimal" quality rating for the stream. This would result in an EII of 1.00 to be applied to the final expected length of new stream channel. The final, "Post-project" EIU is 2275; with an ecological lift of 1078 EIU's.

Section 6: Mitigation Work / Implementation Plan:

I. Site Preparation:
A. *Plans*
KDFWR has developed an integrated plan that would result in the complete restoration of the site's stream. In partnership, the engineering firm Beaver Creek Hydrology designed the stream restoration and collected the necessary stream data using on-site and other data sources.

KDFWR will construct the permitted stream in accordance with the approved plans, and will not make any significant field changes without the prior approval of the Corps and KDOW. KDFWR and/or their consultant will be on-site during the entire construction process and will be supported as needed by a staff ecologist or biologist. During construction, KDFWR and/or their consultant will ensure the use of standard erosion control methods that are applicable to the mitigation site.

Description of plans for the following criteria:
1. Grading – The site will be graded to the dimensions shown on the plans, which include stream gradient, bankfull channel, floodprone area, and hydraulic structures.

2. Hydrologic changes – Temporary hydrologic changes will occur during construction from use of diversion channels and/or "pump around" (the extent of which will be determined by the contractor and engineer in charge). Changes will include opening the new channel to flow and plugging the existing channel as construction progresses in either an upstream or downstream direction. A hydrologic change will result from the use of a more appropriate channel width and from raising the channel bottom above bedrock above and below the undisturbed stream segment on private property.

3. Water control structures – There are no anticipated permanent water control structures. Temporary water control structures may be used to manage flow during construction (i.e., utilizing a "pump around" during construction requiring a temporary damming of the existing channel to cutoff flow for pumping to a point downstream. This operation would be repositioned as necessary while construction progresses).

4. Exotic vegetation control – Exotic vegetation control will involve an initial eradication by use of herbicides. The riparian zone will be limited to no more than 10 percent of

exotic invasive species present during the final vegetation cover survey. Invasive species observed during the monitoring period will be controlled by spot application of herbicides and/or manual removal. The species to be controlled are those indicated as level 1 (Severe Threat) and 2 (Significant Threat) on the list produced by the Kentucky Exotic Pest Plan Council.

5. Erosion control – Geojute erosion control fabric will be installed beginning two feet from the edge of bankfull and extend to the toe of slope of the channel. Silt fencing or other erosion control measures will be constructed, as necessary, along the design channel and riparian corridor and around temporary material stockpiles to prevent the transport of disturbed soils into the design channels. These silt fences and other erosion control methods will be maintained as necessary to ensure their functionality. Other areas will be seeded and mulched as described in detail elsewhere in this document.

6. Bank stabilization – Bank stabilization will be accomplished through the use of erosion control fabric as described above, root wads, and log vanes; as well as rock toe structures along the outside of bends. Grade control structures, in the form of constructed riffles and cross-vanes, are to be utilized to stabilize the streambed.

7. Equipment and procedures to be used – A variety of common equipment and tools will be used as site conditions dictate. Prior to channel construction, the site will be mowed to allow easy access, being especially cautious not to disturb the survey benchmarks established on the site. The channel thalwag will then be laid out in plan form. Stakes with flags will be installed to mark the thalweg and radius points for the design channel. The bankfull channel will then be constructed to the depth and cross section dimensions prescribed in the design. Following the construction of all bankfull design sections, the design channel profile and cross sections will be surveyed and checked against the design values. This process will be repeated until the constructed channel profile and dimensions matches, within an acceptable tolerance, that of the design. Due to the length of the project, it will be necessary to define discrete reaches within the project that can be constructed to prescribed stages before moving on. In this way the project can be constructed while minimizing the amount of flow diversion or pump around, as well as maximizing the efficiency of erosion control and implementation of vegetation. Once this is accomplished, the erosion control blankets and silt fencing will be installed. Riparian vegetation will then be planted.

8. Site access control – The site is protected by the owner against vandalism. Public use and access is not a concern due to the topography, remoteness of the site, and presence of property owners on site. The KDFWR and/or their consultants will monitor access to the site during the construction phase to ensure that damage or vandalism does not occur.

9. Strategy for minimizing soil compaction –Soil compaction will be localized and center around design channels. If necessary, light disking or scarification of planting and

seeding areas will be performed to ensure suitable soil conditions. Additionally, should compaction become an issue, holes for trees and shrubs can be over-excavated and loosely backfilled to facilitate root development.

10. Stream Pattern, Profile, and Dimension – Design stream pattern, profile, and section dimensions were determined by the engineer. These parameters are shown in the plans and based on morphological data and natural stream design concepts.

B. *Soils/Substrate*
The existing stream substrate consists predominantly of sand with lesser amounts of silt/clay material present. Information on the particle size distribution is found in Refer to Phase A Report– 660-C40L-CN01-00.

C. *Hydrology*
Refer to Phase A Report– 660-C40L-CN01-00.

D. *Planting Plan*
KDFWR will restore vegetation to the site. The riparian corridor along the stream will average 25 feet on each side of the channel (easements granted by the property owners limit the zone width). The general plan is as follows:

1. The riparian area - Refer to drawings – 660-C40L-CN01-00.

2. The contractor will determine the source of seeds and plantings. Only native plant species will be planted. KDFWR personnel/or their consultant will inspect the plantings before installation. Annual rye grass may be used in addition to the native seed mix to establish quick cover.

3. All of the planted trees will come from the list in the drawings, and no species will comprise more than 20 percent of the total initial planting. Planting locations or layout are shown on a planting plan detail sheet. They typically will begin at bankfull elevations, or two feet from the edge of stone protection, and extend to the limit of the defined riparian zone. Mostly facultative or wetter species have been selected due to the site being entirely in the floodplain and the soil types present.

4. Transplanting is not proposed for this project. The existing trees are native species, and efforts will be made to leave as many as possible.

5. Expected volunteers species include sycamore, walnut and box elder. This is based on species that currently exist in the area.

E. *Exotic and Undesirable Species Control*
KDFWR and/or their consultants will ensure that invasive species will not affect the future condition of the restored stream and riparian zone. The species to be controlled are those indicated as level 1 (Severe Threat) and 2 (Significant Threat) on the list

produced by the Kentucky Exotic Pest Plan Council. Efforts to reduce introduction will consist of cleaning equipment before it reaches the site, inspecting labels on seed mixtures and mulch for composition. If exotic vegetation establishes, eradication techniques include spraying or manual/mechanical removal. Monitoring for invasive species will take place during the biannual vegetation conducted on the site.

F. *Schedule*
Construction associated with restoration of the stream is tentatively scheduled to begin in the winter of 2009, if the necessary permits are received from the Corps and KDOW. Tree seedlings would be planted in the spring of 2010 if construction is completed by the end of winter. The initial monitoring of the site will commence in the first full growing season post initial planting and will consist of data collected during the beginning and end of the growing season. Depending on the completion of construction and the tree planting, monitoring schedules will be adjusted accordingly.

G. *Construction Monitoring*
KDFWR and/or its consultant will monitor the construction activities to ensure that all aspects of the approved mitigation plan are completed without incident. To accomplish this, KDFWR will require on-site management of the construction personnel by one or more people familiar with the design of the project. These representatives will include the KDFWR Project Manager and their consultants and others familiar with the project that have complete knowledge of the mitigation and design plans and some understanding of soil science, hydrology, botany or plant ecology.

II. As-Built Conditions:
KDFWR will submit a report, including construction documents, to the Corps and KDOW within six (6) weeks of completion of site preparation and planting; describing as-built plans and profiles of the mitigation project, locations of final plantings, structures and other mitigation features, final lengths and areas of restored stream. Separate reports for grading and planting work will be submitted if these are not completed within six weeks of each other. KDFWR will include any deviations from the original plan that will affect the predicted stream credit. Table 1 will be revised based on the "as-builts", reflecting any deviations from the predicted stream credit. This "as-built" credit will be the basis of the annual tracking of the success criteria. The initial planting report will not be considered as a monitoring report.

KDFWR shall also provide topographic maps showing as-built contours for the restored stream and adjacent riparian area. This would entail measurements of stream pattern, profile, and channel dimensions.

Section 7: Success Criteria / Performance Standards

The success criteria/performance standards discussed and shown in Table 2 identify and define the specific criteria for measuring the success of the mitigation effort. The

criteria will be measurable and achievable.

Minimum Success Criteria:
The success criteria for the stream is based on the three primary factors: (1) meeting stream channel geomorphology design characteristics to ensure stream stability and function, (2) achieving predicted habitat assessment scores, and (3) ensuring the adequate establishment of a functional riparian area. The success criteria are shown in Table 2. These criteria are believed adequate to justify expected stream stability and habitat improvements.

Section 8: Monitoring

I. Monitoring Reports: KDFWR will provide an annual report, based on data collected twice per growing season, to the Corps and KDOW by December 31 for each previous year of the 5-year monitoring effort. The annual report will be based on information collected by KDFWR and/or their consultant as described below. The first monitoring report will be completed after the first full growing season following the initial planting of tree seedlings.

Upon submittal of the final annual report, KDFWR will request Corps and KDOW release from further monitoring. The final annual report will include an explanation of how the goals of the mitigation have been met, a discussion of the stream ecosystem's ability to be self-sustaining, and a comparison of the mitigation site's stream both pre- and post-project using the same functional assessment method. An inspection of the site will then be coordinated with KDFWR, their consultants, and the property owners; and conducted by the Corps and KDOW to confirm the successful completion of the mitigation plan. Upon the Corps and KDOW review, and confirmation of the successful completion of the mitigation plan, KDFWR will be released from additional monitoring and reporting requirements.

A. *Timing*
KDFWR and/or their consultants will conduct biannual vegetation inspections with one inspection occurring in the first month and one in the last month of the growing season for each calendar year. Photographs will be taken of the vegetation monitoring plots to get an early-in-the-year record and observe any new problems. KDFWR and/or their consultants will also make several site inspections at the beginning of the growing season during each year of the monitoring period to monitor hydrology. The vegetation monitoring data will be collected during both early and late season site visits and will be included in the annual monitoring report.

B. *Monitoring Methods*
KDFWR and/or their consultants will monitor stream hydrologic characteristics and stability as necessary and appropriate to determine if stream success criteria are being met. For riparian vegetation, the following vegetative monitoring procedures and

protocols will be used:

- Four (4), permanent 0.25 acre vegetation monitoring plots will be created within the restored riparian areas, two in the upper reach and two in the lower reach of the project. These vegetative monitoring plots will be monitored bi-annually, during the early and late growing season for the duration of the monitoring period. If the vegetative success criterion is not met, remedial actions will be taken to meet the vegetative success criterion. All proposed vegetative remedial actions will be approved by the Corps and KDOW.

- A center stake will be established to mark the location of each monitoring plot, and photographs will be taken of these plots annually from a point 25 feet away and due west of the center stake.

- The number of planted hardwoods and the number of volunteer hardwoods of targeted species present will be counted within each plot during each growing season of the monitoring period.

- A qualitative vegetation monitoring survey will also occur at the beginning and end of the growing season. This survey will serve to (a) identify the plant species occurring on the site during both the early and late growing season so that a complete vegetation list can be derived, and (b) provide a bi-annual screening for invasive species, so that those species can be addressed or treated as may be necessary at the earliest possible time.

C. *Documentation*
KDFWR and/or their consultants will document the conditions at the mitigation site and provide a written summary of how the site meets or does not meet the goals and objectives of Section 1 of this plan. The initial report will include a discussion of any deviations from the Mitigation Work/Implementation Plan (Section 6). The following format and sequence will be used in the development of the monitoring report:

1. Soils/substrate – Pebble counts and bar samples will be collected to determine if the size distributions are approximate to those assumed for the design channels.

2. Vegetation – Riparian vegetation conditions observed during the monitoring effort will be identified and compared to pre-project vegetation conditions and to the vegetation success criteria. KDFWR and/or their consultants will assess how the success criteria are being met; including, but not limited to, percent native tree species, maximum percent invasive species, minimum native tree stem density per acre, maximum percent any one tree species, survival rate of planted tree species, ratio of planted tree species vs. volunteer tree species, and percent vegetative cover. KDFWR and/or their consultants will also include a species composition list including both scientific and common names.

3. Hydrology – Hydrologic conditions observed during the monitoring effort will be identified and compared to the hydrologic success criterion. KDFWR and/or their consultants will describe the sources of hydrology (e.g. precipitation, overbank flooding, groundwater) that are or appear to be affecting the site and include information on surface water depth.

4. Channel geomorphology – KDFWR and/or their consultants will describe the as-built profiles, cross sections, in-stream habitat characteristics, and substrate composition. The discussion will related specifically to the Success Criteria (Table 2) and will provide sufficient detail for a reasonable person to judge whether or not the anticipated stream type(s) were restored and that those streams are stable. The restored channels will be visually inspected at least quarterly during the first two years after construction and semi-annually for the remainder of the monitoring period to identify potential signs of instability. Photographs of the stream channels will be taken to document changes in the channels, especially sites where instability may be occurring.

5. Remediation – KDFWR and/or their consultants will describe any remedial measures that will be necessary to ensure successful establishment the restored streams on the site.

D. *Responsible Parties*

1. Applicant
   Kentucky Department for Fish & Wildlife Resources
   Attn: Mr. Andy Mowrey
   1 Sportsman's Lane
   Frankfort, Kentucky 40601
   502/564-3400

2. Party Responsible for Oversight of Construction of Mitigation
   Kentucky Department for Fish & Wildlife Resources
   Attn: Mr. Andy Mowrey
   and,

   Beaver Creek Hydrology, LLC
   106 Mission Court
   Suite 101B
   Franklin, TN 37067

3. Party Responsible for Mitigation Plan Implementation, Success & Credit/Debit Tracking
   Kentucky Department for Fish & Wildlife Resources
   Attn: Mr. Andy Mowrey
   1 Sportsman's Lane
   Frankfort, Kentucky 40601

II. Assessment of Function/Value Replacement: In the annual report, KDFWR and/or their consultants will use the EPA Rapid Bioassessment protocol of high gradient streams to measure stream and riparian habitat improvements and describe those results in the annual report. If a success criterion is not met for all or any portion of the mitigation area in any year, KDFWR and/or their consultants shall also provide an analysis of the cause(s) of failure and any proposed remedial action(s). The annual report will also include photographs of each monitoring plot.

III. Release from Monitoring: Prior to requesting release from monitoring, KDFWR and/or their consultants will conduct a delineation of the mitigation site. The preliminary delineation will be submitted with the final annual monitoring report and will designate the reach and associated riparian zone width restored or enhanced. The Corps and KDOW will then have the opportunity to verify the delineation during a site inspection. If the Corps and KDOW determine the delineation is correct, the boundary will be surveyed, and a certified copy of the final delineation will be provided to the Corps and KDOW. If revisions to the delineation are necessary, the boundary will be remarked during the site inspection and then surveyed, and a certified copy of the final delineation will be provided to the Corps and KDOW.

Section 9: Long Term Management Plan

The stream that is restored and enhanced on the site (including the riparian zone for which credit was given) will be permanently protected and remain undisturbed. The landowner will protect the entire delineated mitigation site through a conservation easement, executed with KDFWR, which permanently protects the mitigation site and significantly restricts the use of the delineated area.

KDFWR will provide funds to permanently mark the boundaries of the mitigation area and place signs stating no mowing, spraying, disturbance, etc., which will include the restored stream and surrounding riparian area. Future management of the site will largely consist of landowner passive management, which will allow the stream and riparian area to develop and evolve naturally.

Section 10: Adaptive Management Plan

KDFWR will take reasonable and appropriate steps to ensure that the stream channel, vegetation, and hydrology are restored on the site in order to achieve the success criteria described above. However, site and other limitations (e.g., engineering considerations and extraordinary flood events) may create situations where stream channel and riparian zone success criteria are not and/or cannot be met fully or in part

on portions of the site. This may be an inevitable outcome of this project. KDFWR recognizes that the Corps and KDOW likely will not give stream credit for those areas that do not meet the vegetative, hydrologic, and stability criteria necessary for the geomorphic, vegetation, and habitat criteria for streams.

The project will be monitored until the Corps and KDOW deem the project is successful. If the objectives of the mitigation plan cannot be met or if a success criterion is not met for any portion of the project in any year, or if the success criteria are not satisfied, KDFWR shall prepare an analysis of the cause of failure. If determined necessary by the Corps and KDOW, KDFWR will propose remedial action to those agencies for pre-approval. KDFWR will then undertake the corrective measures to address or repair the problem(s).

Section 11: Financial Assurances

KDFWR has sufficient funding through the In-Lieu Fee Trust to construct and monitor the mitigation project, and has provided sufficient contingency funds for remedial actions. The property owners have the resources to manage and protect the site in the long-term. The Corps and KDOW hold the applicant, KDFWR, ultimately responsible for project success, including financial assurances.

Table 1. EUI Credit Calculation

		Maturity
RBI Habitat Parameters	**Pre-Construction**	**Post Const.**
Epifaunal substrate	11	20
Embeddedness	10	20
Velocity/depth regime	13	20
Sediment deposit	10	15
Channel flow status	7	5
Channel alteration	6	16
Frequency of riffles	15	15
Bank stability (both banks)	14	20
Vegetative protection (both banks)	10	20
Riparian width (both banks)	4	20
	100	171
Reach Length (feet)	2179	2275
Conductivity μS	36	36
E. KY Protocol EII	0.55	1
E. KY Protocol EIU's	1196.8	2275
	Ecological Lift (EUI's)	1078.2

Table 2. Success Criteria

Habitat Assessment Criteria		**Pre-project Value**		**Target RBP score at end of monitoring period**
RBP Habitat Assessment Score		100		171
Vegetation Criteria			**Design Value**	**Target value at end of monitoring period**
Min. # Total Stems/Acre			400	300
Min. # Dominant/Co-dominant Overstory Trees/Acre			222	180
Max. % Comprised by Any One Species			20	<25
Max. % Non-native Invasive Species			0	<10
Morphology Criteria			**Design Value**	**Target value range (min./max.)**
Riffle	Bankfull Cross-sectional Area (A_{bkf})		10.15	8-12
	Bankfull Width (W_{bkf})		14.5 ft	12-16
	Width/Depth Ratio		20.62	20-22
	Entrenchment Ratio		1.76	1.6-1.8
	Bank Height Ratio		1	1-1.2
Pool	Bankfull Cross-sectional Area (A_{bkf})		10.35	8-12
	Bankfull Width (W_{bkf})		15	12-16
	Max. Depth (D_{max})		1.4	1-2
Profile	Avg. WS Slope		0.026	0.02-0.03
	Ratio: Riffle Slope/Avg. WS slope		1.57	1.4-1.8
	Ratio: Pool Slope/Avg. WS slope		0.5	0.5-1
	Ratio: Pool-pool Spacing/Bankfull Width (W_{bkf})		3-4	3-4
Stability Criteria		**Stream Type**	**Pre-project Rating/Condition**	**Monitored Condition**
Channel Stability Evaluation Rating		B4	115/Poor	"Good" during every monitored year
Hydrology Criteria				**Annual Peak Stage Recorded**
Bankfull stage				Bankfull event occurs in minimum of 2 of the 5 years monitored

Table of Contents

1. INTRODUCTION

Cranes Nest Branch is a small tributary in the Richland Creek watershed in the Upper Cumberland River basin, which is designated as a conservation area for fish and lamprey species. The current project reach of Cranes Nest Branch is a 2,300-ft headwater stream located on the private property belonging to Mrs. Robin Rosenstiel Jones and Mr. Richard Jones.

Historical stream impacts include mining, deforestation, channelization, agriculture, channel relocation (see photograph on cover), and riparian zone removal. This project entails the restoration (Priority I and Priority II) and enhancement of Cranes Nest Branch in order to improve aquatic habitats, primarily for macroinvertebrates, reduce streambank erosion and stabilize the channel bed. Due to the willingness of the landowners, a restored channel will be constructed throughout the majority of the project area. Priority I restoration involves placement of a new channel at a higher elevation than the existing bed in order to connect to an existing floodplain; Priority II restoration involves excavating a new channel and floodplain at the existing channel grade.

The existing channel is entrenched and extremely sinuous, having formed in a gully controlled by tree growth and soil inclusions, throughout the majority of the project area. The sharp bends are severely eroding. KYFW data provided in the project RFP indicate the Bank Erodibility Hazard Index (BEHI) measured at these failing banks, yielding a score of 42.4, is very high. Within the middle of the project area, a section of the channel has been straightened and used as a road (see Cover photo). As a result, the habitat is dominated by a shallow run with bedrock substrate as the dominant bed feature. Upstream of the straightened reach the channel is formed in a gully, or G streamtype, as shown in Figure 1.

3. HYDROLOGY

Estimates of design surface water discharge values were calculated based on the approach of correlation with geomorphologic features and detailed hydraulic modeling which will be discussed in the following section. Regional regression equations were also used to compare the results in terms of flood frequency (USGS StreamStats), and these calculated values are shown in Table 1.

Table 1. Flood frequency discharge estimates

Return Interval (year)	Discharge (cfs)
2	48
5	81
10	104
25	135
50	158
100	181
500	236

4. HYDRAULICS

The bankfull discharge is the reference flow used for natural channel design and sediment transport analysis. The bankfull discharge for the Cranes Nest project reach was estimated using a combination of the hydrological data listed in Table 1 and a detailed hydraulic model. HEC-GeoRAS and HEC-RAS 4.0 (USACE) were used to build a hydraulic model and to calculate water surface profiles and other flow parameters for a range of steady flow values overlapping the flood frequency values shown in Table 1 and lower flow values ranging to 0.1 cfs. The hydraulic model is based on cross-sectional data obtained from topographic survey and converted to a 1-ft resolution digital elevation model from which a steady-state flow analysis is performed. A total of 109 cross-sections were extracted from the topographic data, located along the solid black lines shown in Figure 6. Model roughness parameters were based on the geomorphic sampling of bed and bank materials and further empirically corrected to include the effects of turbulence and large eddies.

First, the hydraulic model was used to calculate the bankfull discharge to assess the channel capacity. The flow capacity at bankfull discharge is a key design parameter for the natural channel design approach. The bankfull discharge was determined by varying the flow rate in the hydraulic model for the existing conditions geometry until the calculated water surface profiles fit well the field-identified bankfull elevation indicators. This method resulted in a bankfull discharge estimate of 56.4 cfs. The regional correlation based flood frequency discharge values shown in Table 1 indicate that the bankfull discharge has a flood-frequency return interval value slightly greater than 2-years, which is consistent with previous findings for incised, intermittent channels measured in streams across the U.S. (Leopold *et al.* 1964).

5. NATURAL CHANNEL DESIGN AND SEDIMENT TRANSPORT ANALYSIS

The Cranes Nest project reach lies in Valley Type II (Rosgen 1994), which is generally described as relatively stable with moderate slopes and valley floor slopes less than 4% with alluvial or colluvial soils formed from parent materials. "The stream type generally associated with Valley Type II are the 'B' types which are generally stable stream types, with low sediment supply and bed features normally described as "rapids"" (Rosgen 2004). The hydraulic model output indicate that for flood flows Cranes Nest Branch reaches conditions which are nearly critical to critical with Froude numbers, which is consistent with rapid dominated channels. B4 stream types normally develop in stable alluvial fans, colluvial deposits and structurally controlled drainageways. The channel bed of B4 streams is dominated by gravels and is characterized as rapid sections with irregularly spaced scour pools. Woody debris is an important component of fisheries [and macroinvertebrate] habitat where available (Rosgen 2004).

To assist with natural channel design and to verify the bankfull discharge estimate, a regionalized variable analysis was performed by BCH on reference B streamtypes having similar morphology as Cranes Nest and described further in the next subsection.

5.1 Regionalized Variables

A reference discharge value, i.e. the bankfull flow, was established with the aid of field-measured hydraulic geometry acquired by BCH at stable riffle cross sections on-site and in stable reference streams. This method uses the strategy of correlating surface flow hydrology to the hydraulic properties measured or modeled from data collected at nearby sites where field indicators of bankfull elevation are easily identifiable, e.g. floodplains, sediment gradation change, vegetation change, tops of point bars,

Table 2. NCD Model Boundary Conditions

Drainage Area:	0.36 sq mi
Valley Slope:	0.0293 ft/ft
Bankfull Discharge:	56.44 cfs
Bankfull Cross Sectional Area:	10.19 sq ft
Mean Depth Calculation Tolerance:	0.2 ft
Riffle Bed Material D84:	43.24 mm
Riffle Bed Material D50:	10.68 mm
Bar Sample Dmax:	110 mm
Bar Sample D50:	3.2 mm
Entrainment Options:	Shields Entrainment Function

Table 3. NCD Model Output

--Planform Alignment--	
Sinuosity:	1.12
Bankfull Slope:	0.02621
--Riffle Cross Sectional Properties--	
Width to Depth Ratio:	20.62
Entrenchment Ratio:	1.76
Floodprone Width:	25.52 ft
Bankfull Width:	14.5 ft
Bankfull Mean Depth:	0.7 ft
Bankfull Velocity:	5.54 ft/s
Bankfull Hydraulic Radius:	0.64 ft
Bankfull Shear Stress:	1.047 lbs/sq ft
Required Roughness (Manning's n):	0.0323 ft^(1/6)
Entrainable Particle Size:	94.7 mm
--Rosgen Stream Classification--	
Reference Reach :	B 4/1
Proposed Reach :	B 4/1
Existing Reach :	B 4/1
--Sediment Transport Competency--	
Ratio - Riffle Slope / Bankfull Slope:	1.57
Ratio - D50bed / D50bar:	3.338
Critical Dimensionless Shear Stress (1):	0.0292
Required Mean Depth:	0.66 ft

Bedload sediment transport capacity was estimated using an entrainment function formulated with critical dimensionless shear stress, a method based on empirical data for gravel-bed rivers. The results

of the capacity analysis include the estimated mean depth (at bankfull discharge) required to transport the largest particles measured in sediment deposits within the active channel is 0.7-ft.

5.4 Design of Hydraulic Structures

Hydraulic features at smaller scales than captured by the HEC-RAS model are expected to occur due to the proposed placement of habitat and grade control structures. These types of fluid motions are three-dimensional and not capable of being incorporated into the one-dimensional, steady state HEC-RAS model without drastic simplifying approximations. The hydraulic structures included in this restoration plan are intended to redistribute the local bed shear stress in order to promote sediment transport in the vicinity of the scour pools located at each structure and therefore to provide habitat enhancements in this otherwise degraded project reach. Sediment transport capacity is expected to be increased in the vicinity of the vanes. The hydraulic structures were checked with an empirical design approach appropriate for B4 streamtypes (Rosgen 2008). These structures are made of placed boulders bedded firmly in the existing substrate and protrude no more than approximately 10% of bankfull depth above the channel substrate. Boulder sizing for the structures was calculated using the following relationship developed from empirical data collected by Rosgen in the aforementioned reference:

$$D = 0.1724 \ln(\tau) + 0.6349, \qquad (1)$$

where τ is the bankfull shear stress (converted to units of kg/m^2)and D is assumed to mean the equivalent spherical diameter of the minimum boulder size in units of meters. The data used for this model included the influence of hydrodynamic lift due to fully developed turbulence in rough channels at near critical Froude numbers in the ranges of discharge values and slopes consistent with geomorphology and hydraulic conditions at the project site. The HEC-RAS model results indicate that the highest bankfull shear stress τ in the project reach is approximately 1.0 lb/ft^2, resulting in a minimum boulder size D of 3.0 ft based on the bankfull discharge. We checked this size using the additional design flow model runs for higher flows. The maximum channel shear stresses occur at the 500-year flood and generally range from 1 to 3 lb/ft^2 (4.88 to 14.6 kg/m^2). Assuming Equation (1) is applicable for these larger flows, the diameter of surface boulders D is 3.6 ft in order to withstand the 500-year flood frequency flow.

Recycled gravel and cobble particles excavated from the channel bed and imported from off-site will be placed and compacted around the boulders in all hydraulic structures and bankfull channel limits.

This material, termed "interstitial fill" or "cutoff sill" or "natural bed material" has a particle size calculated using the following equation given in (UDFCD 2008) paragraph 4.4.2.3 for sizing riprap:

$$\frac{VS^{.17}}{d_{50}(G_s - 1)} = 4.5, \qquad (2)$$

where V is the mean channel velocity for the 100-year flood in units of ft/s, S is the channel slope, d_{50} is the mean rock diameter in units of ft and G_s is the specific gravity of the rock. From the HEC-RAS output, the maximum mean channel velocities in the project reach are on the order of V = 7 ft/s and slope S = 0.022. Using G_s = 2.5 equation (2) yields a conservative mean rock size d_{50} of 0.542 ft (6-1/2 inch stone) for the interstitial fill and other course channel bed material based on the 100-year flow event. Based on experience this represents the largest size of particles in the size distribution for placed bed material.

The resulting channel alignment and structures sized for the appropriate channel morphology and flow events are shown at locations noted on the Concept Plan (Attachment A). The RIVERMorph design output for cross-vane and other grade control features shown in the Concept Plan, based on the aforementioned Rosgen approach, is provided below in Table 4.

Table 4. Hydraulic Structure Design Results

Bank Height:	1.1 ft
Bankfull Height:	0.7 ft
Shear Stress:	1.047 lbs/sq ft
Near Bank Stress:	1.2 lbs/sq ft
Bankfull Slope:	0.02621 ft/ft
Bankfull Width:	14.5 ft
Min. Radius of Curvature:	72.5 ft
Plan View Vane Angle:	30 deg
Ratio - Rc/Wbkf:	N/A for B4 streamtype (use 3 to 5 for stability)
Vane Spacing:	46.5 ft
Vane Length:	12.6 ft
Minimum Rock Size (Eq. Circle Diameter):	3.0 ft
Vane Slope:	5.6 %

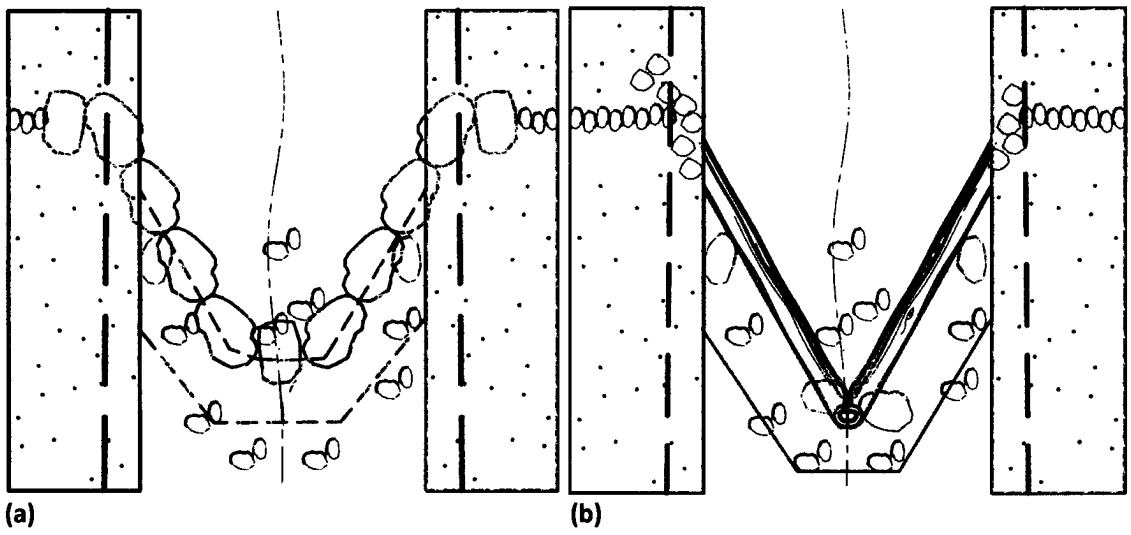


Figure 15. Plan views of boulder cross vane (a) and log wedge vane (b) grade control structures appropriate for the Cranes Nest restoration. The bankfull channel limits and water surface (not shown) are represented with vertical dashed lines and the flow is from the bottom of the page to the top. The hatched symbol represents coir fiber matting placed on the banks, anchored with dead and live stakes. The solid hatch represents filter fabric placed under the structure in the channel bed. The surface boulders (logs) shown in (a,b) each sit firmly on a footing boulder (log, respectively). The surface logs in (b) are shown buried in the channel bed and banks and covered with interstitial fill.

Additional habitat features such as anchored woody debris, e.g. felled logs with attached rootwads, two low-ford crossings and one oxbow pond are shown in the Concept Plan to increase habitat diversity throughout the project area and be consistent with the natural channel design approach.

The Concept Plan based on the NCD output and the proposed conservation area and reforested buffer zone, measured relative to the location of the proposed bankfull channel limits plus a 25-ft offset, is sketched in Attachment A, along with the locations of the major hydraulic and habitat features. Attachment B is the Phase A cost estimate and Attachment C is the Phase A schedule that accompany this Concept Plan.

REFERENCES

Andrews, E. D., and Nankervis, J. M. (1995). *Effective Dishcarge and the Design of Channel Maintenance Flows for Gravel-Bed Rivers*, AGU.

Leopold, L. B., Wolman, M. G., and Miller, J. P. (1964). *Fluvial Processes in Geomorphology*, Dover Publications, Inc, New York.

Rosgen, D. L. (1994). "A classification of natural rivers." *Catena*, 22, 169-199.

Rosgen, D. L. (2000). "Natural Channel Design Methodology." In: *Natural Channel Design and River Restoration*, D. L. Rosgen, ed., Wildland Hydrology, Inc., Pagosa Springs, Colorado, USA.

Rosgen, D. L. (2004). "WARSSS Assessment Methodology." Wildland Hydrology, LLC.

Rosgen, D. L. (2008). "The Cross-Vane, W-Weir and J-Hook Vane Structures." Wildland Hydrology, Inc., Fort Collins, Colorado.

UDFCD. (2008). "Drainage Manual." Urban Drainage and Flood Control District, Denver, Colorado.

ATTACHMENT A (SEE FOLLOWING PAGE)

GENERAL NOTES

1. ALL BEARINGS ARE BASED ON NORTH AMERICAN DATUM (NAD) 1983 KY STATE PLANE GRID BEARINGS. ALL DISTANCES AND COORDINATES SHOWN ARE HORIZONTAL (GROUND) VALUES.
2. ALL ELEVATIONS ARE SHOWN IN FEET ABOVE MEAN SEA LEVEL. ALL DEPTHS ARE MEASURED RELATIVE TO PROPOSED BANKFULL ELEVATION.
3. THE CONSERVATION EASEMENT SHOWN HAS BEEN RECORDED WITH THE KENTUCKY DEPARTMENT OF FISH AND WILDLIFE RESOURCES.
4. THE DISTURBED AREA SHOWN AROUND THE NATURAL GAS WELL WAS REGRADED SINCE THESE PLANS WERE DEVELOPED. THIS AREA SHOULD BE STABILIZED BY OTHERS PER STATE AND FEDERAL REGULATIONS PRIOR TO CONSTRUCTION OF THE CRANES NEST BRANCH PROJECT.
5. PLACEMENT OF SEDIMENTATION AND EROSION CONTROLS SHALL BE IN ACCORDANCE WITH FEDERAL, STATE AND LOCAL EROSION CONTROL REGULATIONS.
6. CONTRACTOR SHALL KEEP ALL SURROUNDING PUBLIC ROADWAYS AND DRAINAGE SYSTEMS FREE FROM SEDIMENT AND CONSTRUCTION DEBRIS IN ACCORDANCE WITH THE EROSION CONTROL PLANS.
7. CONTRACTOR SHALL BE RESPONSIBLE FOR THE REPAIR OF ANY ITEMS DAMAGED DURING CONSTRUCTION, INCLUDING FENCING, ROADS, ETC.
8. ALL EARTH MOVING EQUIPMENT SHALL BE SERVICED PRIOR TO WORK COMMENCING EACH MORNING. EQUIPMENT SHALL BE MAINTAINED TO PREVENT FUEL, OIL AND LUBRICANT SPILLS IN THE VICINITY OF THE STREAM.
9. ENGINEER RESERVES THE RIGHT TO MAKE ADJUSTMENTS IN THE FIELD TO STREAM PLAN AND PROFILE DIMENSIONS, STRUCTURE LOCATIONS, STRUCTURE DETAILS, AND ALL OTHER RELEVANT EROSION CONTROL PRACTICES AS NEEDED TO PRESERVE TREES AND OTHER HABITAT AND TO FIT SITE CONDITIONS.
10. TOPOGRAPHIC SURVEY PERFORMED BY BLANTON LAND SURVEYING, JANUARY 2009.
11. IMAGE SOURCE: USDA NAIP 2008 AERIAL PHOTOGRAPH

SUBSURFACE:

12. NO SUBSURFACE DATA IS MADE AVAILABLE TO THE CONTRACTOR FOR THIS PROJECT. THE CONTRACTOR SHALL BE RESPONSIBLE FOR SUBSURFACE INVESTIGATIONS AS THEY RELATE TO THIS PROJECT.

MATERIALS:

13. EXCAVATED MATERIAL SHALL TEMPORARILY BE STOCKPILED IN NON-FORESTED AND NON-WETLAND AREAS WITHIN THE LIMIT OF DISTURBANCE. EXACT LOCATION OF THE TEMPORARY STOCKPILE AREAS SHALL BE DETERMINED BY THE CONTRACTOR AND APPROVED BY THE ENGINEER. THE CONTRACTOR SHALL BE RESPONSIBLE FOR INSTALLING APPROPRIATE STABILIZATION MEASURES OUTSIDE THE STOCKPILE AREAS TO PREVENT EROSION AND SEDIMENTATION.
14. TREES SPECIALLY MARKED BY THE ENGINEER WITH AN "LV" ARE SUITABLE FOR REUSE AS LOG VANES, ROOT WADS, COVER LOGS AND OTHER HABITAT FEATURES. SOME TREES HAVE BEEN MARKED FOR PRESERVATION WITH THREE ORANGE PAINT SPOTS AT BREAST HEIGHT.
15. SEE DETAILS, PLAN AND PROFILE VIEWS, PLANTING PLAN, AND EROSION CONTROL PLAN FOR ADDITIONAL NOTES AND SPECIFICATIONS.

UTILITIES:

16. THE CONTRACTOR SHALL FIELD VERIFY ALL UTILITIES INSIDE THE LIMIT OF DISTURBANCE.
17. A WATER LINE CROSSES THE STREAM AT APPROXIMATELY STATION 19+35. THE EXACT LOCATION OF THE WATER LINE AND ITS LOCATION ARE NOT KNOWN. THE CONTRACTOR IS RESPONSIBLE FOR ANY DAMAGE TO THE EXISTING WATER LINE AT NO COST TO THE OWNER.
18. THE EXISTING NATURAL GAS LINE IS SHOWN ON THE PLANS. THE LOCATION OF THIS LINE IS ALSO APPROXIMATE. THE CONTRACTOR IS RESPONSIBLE FOR ANY DAMAGE TO THE NATURAL GAS LINE AT NO COST TO THE OWNER.
19. THE CONTRACTOR SHALL BE RESPONSIBLE FOR ANY DAMAGE INCURRED TO ANY UTILITY SERVICE LINE AT NO COST OR OBLIGATION TO THE OWNER.
20. THE CONTRACTOR MUST CALL THE "CALL BEFORE YOU DIG" NUMBER FOR UTILITY LOCATIONS (800-752-6007 OR 811).

EROSION CONTROL NOTES

TOTAL AREA DISTURBED: 4.2 ACRES

1. THE CONTRACTOR SHALL INSTALL AND MAINTAIN THROUGHOUT THE PROJECT ALL EROSION CONTROL MEASURES IN ACCORDANCE WITH THESE PLANS AND IN ACCORDANCE WITH ALL APPLICABLE LOCAL, STATE AND FEDERAL EROSION CONTROL REGULATIONS.
2. LOW WATER CROSSINGS TO BE INSTALLED WILL BE PERMANENT INSTALLATIONS AND SHALL BE INSTALLED ACCORDING TO THE CONSTRUCTION DRAWINGS.
3. THE CONTRACTOR SHALL CONTINUOUSLY MAINTAIN ALL EROSION CONTROL DEVICES AND STRUCTURES TO MINIMIZE EROSION.
4. EROSION AND SEDIMENT CONTROL MEASURES SHALL BE MAINTAINED CONTINUOUSLY, RELOCATED WHEN NECESSARY, AND SHALL BE CHECKED AFTER EVERY RAINFALL. SEEDED AREAS SHALL BE CHECKED REGULARLY AND SHALL BE WATERED, FERTILIZED, RESEEDED AND MULCHED AS NECESSARY TO OBTAIN A DENSE STAND OF GRASS.
5. STABILIZATION IS THE BEST FORM OF EROSION CONTROL. STABILIZATION INCLUDES ALL SEEDING, MULCHING, CRIMPING, SILT CONTROLS, COIR MATTING, AND DIVERSIONS WHERE INDICATED ON THE PLANS. ALL DISTURBED AREAS THAT ARE NOT OTHERWISE STABILIZED SHALL BE AMENDED AND SEEDED, TEMPORARILY OR PERMANENTLY. PERMANENT SEEDING AND GRASS ESTABLISHMENT ARE REQUIRED PRIOR TO PROJECT COMPLETION AND ACCEPTANCE.
6. SEED AND MULCH WILL BE PLACED ON EXPOSED SLOPES WITHIN 14 CALENDAR DAYS FOLLOWING COMPLETION OF ANY PHASE OF GRADING. PERMANENT SEED AND MULCH FOR ALL DISTURBED AREAS SHALL BE PROVIDED AS DIRECTED IN THE PLANTING PLAN.
7. ALL TEMPORARY EROSION AND SEDIMENT CONTROL MEASURES CAN BE REMOVED WITHIN 14 DAYS AFTER FINAL SITE STABILIZATION (SEEDING AND MULCHING) OR AFTER THE TEMPORARY MEASURES ARE NO LONGER NEEDED AS DIRECTED BY THE ENGINEER. TRAPPED SEDIMENT AND THE DISTURBED SOIL AREAS RESULTING FROM THE DISPOSITION OF TEMPORARY MEASURES SHALL BE PERMANENTLY STABILIZED TO LIMIT FURTHER EROSION AND SEDIMENTATION.
8. WHERE SEDIMENT IS TRANSPORTED ONTO A PAVED OR PUBLIC ROAD, THE ROAD SURFACE SHALL BE CLEANED THOROUGHLY AT THE END OF EACH DAY. SEDIMENT SHALL BE REMOVED FROM THE ROADS BY SHOVELING OR SWEEPING AND TRANSPORTED TO A SEDIMENT CONTROL DISPOSAL AREA. STREET WASHING SHALL BE ALLOWED ONLY AFTER SEDIMENT IS REMOVED IN THIS MANNER.
9. WHEN A CRUSHED STONE CONSTRUCTION ENTRANCE HAS BEEN COVERED WITH SOIL OR HAS BEEN PUSHED INTO THE SOIL BY CONSTRUCTION TRAFFIC, IT SHALL BE REPLACED WITH A DEPTH OF STONE THAT WAS SPECIFIED.
10. INSPECTIONS OF ALL CONTROL MEASURES AND DISTURBED AREAS MUST BE PERFORMED BEFORE ANTICIPATED STORM EVENTS (OR SERIES OF STORM EVENTS SUCH AS INTERMITTENT SHOWERS OVER ONE OR MORE DAYS), AND WITHIN 24 HOURS AFTER THE END OF A STORM EVENT OF 0.5 INCHES OR GREATER, AND AT LEAST ONCE EVERY FOURTEEN CALENDAR DAYS. INSPECTIONS MUST BE DOCUMENTED AND INCLUDE THE SCOPE OF THE INSPECTION, NAME(S) AND TITLE OR QUALIFICATIONS OF PERSONNEL MAKING THE INSPECTION, THE DATE(S) OF THE INSPECTION, MAJOR OBSERVATIONS RELATING TO THE IMPLEMENTATION OF THE CONTROL MEASURES (INCLUDING THE LOCATION(S) OF DISCHARGES OF SEDIMENT OR OTHER POLLUTANTS FROM THE SITE AND OF ANY CONTROL DEVICE THAT FAILED TO OPERATE AS DESIGNED OR PROVED INADEQUATE FOR A PARTICULAR LOCATION). BASED ON THE RESULTS OF THE INSPECTION, ANY INADEQUATE CONTROL MEASURES OR CONTROL MEASURES IN DISREPAIR MUST BE REPLACED OR MODIFIED, OR REPAIRED AS NECESSARY, BEFORE THE NEXT RAIN EVENT IF POSSIBLE, BUT IN NO CASE MORE THAN SEVEN (7) DAYS AFTER THE NEED IS IDENTIFIED.
11. STRUCTURAL PRACTICES TO DIVERT FLOWS FROM AREAS OF LAND DISTURBANCE, STORE FLOWS OR OTHERWISE LIMIT RUNOFF AND THE DISCHARGE OF POLLUTANTS FROM EXPOSED AREAS OF THE SITE MUST BE IMPLEMENTED. SUCH PRACTICES MAY INCLUDE SILT FENCES, EARTH DIKES, DRAINAGE SWALES, SEDIMENT TRAPS, CHECK DAMS, SUBSURFACE DRAINS, PIPE SLOPE DRAINS, STORM DRAIN INLET PROTECTION, AND OTHER APPROVED PRACTICES. ALL BEST MANAGEMENT PRACTICES SHALL MEET OR EXCEED FEDERAL AND STATE REQUIREMENTS.

SITE PRESERVATION AGREEMENT:

12. THE CONTRACTOR SHALL BE RESPONSIBLE FOR REPAIRING ANY DAMAGE TO EXISTING ROADS, GATES, FENCES, ETC. CONSTRUCTION ENTRANCES SHALL BE INSTALLED AT ALL ACCESS LOCATIONS PER THE PLANS AND SPECS.
13. THE CONTRACTOR SHALL BE RESPONSIBLE FOR ANY IMPROVEMENT TO THE ROAD CONDITIONS, GATES, AND FENCES REQUIRED FOR ACCESS DURING CONSTRUCTION.

EROSION CONTROL MEASURES DURING CONSTRUCTION:

14. DURING CONSTRUCTION THE CONTRACTOR SHALL BE RESPONSIBLE FOR INSTALLING ADDITIONAL EROSION CONTROL MEASURES NOT SHOWN ON THE PLANS BUT NECESSARY TO CONTROL EXCESS SEDIMENT, AS DETERMINED BY THE ENGINEER.

STAGING AND STOCKPILES AREAS:

15. SPECIFIED AREAS SHOWN ON THE PLANS HAVE BEEN ESTABLISHED AS STAGING AND STOCKPILING AREAS. THE CONTRACTOR MAY ESTABLISH ADDITIONAL STAGING AND STOCKPILING AREAS ALONG THE PROJECT, AS NECESSARY, TO CARRY OUT THE WORK. ALL STAGING AND STOCKPILING AREAS MUST BE INSIDE THE LIMITS OF DISTURBANCE AND APPROVED BY THE ENGINEER. SILT FENCE WILL BE INSTALLED AROUND ALL STOCKPILE AREAS THAT HAVE BEEN DISTURBED AS DIRECTED BY THE ENGINEER OR AS SHOWN ON THE PLANS.
16. AREAS MARKED AS LIMITS OF DISTURBANCE ARE FOR PERMANENT STOCKPILING OF EXCAVATED FLOODPLAIN MATERIALS. LOCATIONS OF THESE PERMANENT STOCKPILES CAN BE CHANGED WITH APPROVAL FROM THE ENGINEER AND THE OWNER.
17. HAUL ROUTES CAN BE ESTABLISHED WITHIN THE CONSERVATION EASEMENT BOUNDARY DURING CONSTRUCTION AS NEEDED TO HAUL MATERIALS.

RAIN GAUGE:

18. THE CONTRACTOR SHALL BE RESPONSIBLE FOR HAVING A RAIN GAUGE ON THE PROJECT SITE FOR RECORDING DAILY RAINFALL AMOUNTS DURING CONSTRUCTION.

SEQUENCE OF CONSTRUCTION

THE CONTRACTOR IS RESPONSIBLE FOR FOLLOWING THE SEQUENCE OF CONSTRUCTION IN ACCORDANCE WITH THE PLANS. ANY CHANGES TO THIS SEQUENCE MUST BE APPROVED BY THE DESIGN ENGINEER.

1. IDENTIFY ALL SIGNIFICANT PROJECT BOUNDARIES, ACCESS POINTS, LIMITS OF DISTURBANCE AND CONTRACTOR STAGING AREAS WITH THE ENGINEER.
2. ESTABLISH HAUL ROUTES AND CONTRACTOR STAGING AREAS.
3. INSTALL EROSION CONTROL MEASURES IN ACCORDANCE WITH THE EROSION CONTROL PLAN.
4. CLEAR AS DIRECTED WITHIN THE LIMITS OF DISTURBANCE AS NEEDED TO EXCAVATE AND PLACE FILL MATERIAL WITHIN THE AREAS SHOWN ON THE PLANS.
5. BEGIN WORK AT STA. 0+00 AND PROCEED IN THE DOWNSTREAM DIRECTION.
6. GRADE THE CHANNEL AND BANKS TO THE LINES SHOWN ON THE PLANS.
7. PLACE CHANNEL LINING, STRUCTURES, COIR MAT AND EROSION CONTROL MEASURES AS SHOWN ON THE PLANS. STRUCTURE LOCATIONS ARE DENOTED BY THE POINT WHERE THE STRUCTURE CROSSES THE PROJECT BASELINE AND SHOWN IN THE STRUCTURE TABLE. INVERT ELEVATIONS REFER TO THE ELEVATION OF THE TOP OF THE STRUCTURE IN THE CHANNEL BOTTOM.
8. PLANT, SEED AND MULCH ALL DISTURBED AREAS IMMEDIATELY AFTER CONSTRUCTION PER THE EROSION CONTROL PLAN.
9. PREPARE AND PLANT ALL RIPARIAN VEGETATION ACCORDING TO THE PLANS AND AT THE DIRECTION OF THE ENGINEER.
10. WALK THE PROJECT SITE WITH THE ENGINEER TO DEVELOP A FINAL CHECK-LIST OF ITEMS LEFT TO BE COMPLETED.
11. REPAIR/FINISH ITEMS IDENTIFIED ON THE FINAL CHECK-LIST.
12. WALK THE PROJECT SITE WITH THE ENGINEER AND OWNER TO APROVE PROJECT COMPLETION.
13. REMOVE ALL WASTE GENERATED FROM THE PROJECT AND RESTORE ALL STAGING AND STOCKPILE AREAS TO THEIR ORIGINAL APPEARANCE. SEED AND MULCH ALL DISTURBED AREAS WITH THE APPROPRIATE SEED MIX.
14. THIS PROJECT SHALL BE CONSTRUCTED IN DRY STREAM CONDITIONS. PUMP-AROUND OPERATIONS ARE REQUIRED.

SURVEY CONTROL POINTS

Number	Northing	Easting	Elevation	Pt Name
1	1862754.0	2186148.1	1075.0	CPt1
2	1862820.4	2186238.5	1077.7	CPt2
3	1862654.6	2186073.2	1067.0	CPt3

STRUCTURE LIST

ID	STA	STRUCTURE	IE	NORTHING	EASTING	ID	STA	STRUCTURE	IE	NORTHING	EASTING
1	0+00	*Log Cross Vane*				29	11+21	*Lunker*			
2	0+86	*Log Cross Vane*				30	11+61	*Boulder Cross Vane*			
3	1+72	*Log Cross Vane*				31	12+10	*Boulder Cross Vane*			
4	2+58	*Log Cross Vane*				32	12+59	*Log Cross Vane*			
5	2+75	*Rootwad*				33	13+07	*Log Cross Vane*			
6	2+85	*Rootwad*				34	13+66	*Log Cross Vane*			
7	2+90	*Rootwad*				35	14+07	*Log Cross Vane*			
8	3+44	*Log Cross Vane*				36	15+09	*Log Cross Vane*			
9	4+30	*Boulder Cross Vane*				37	15+20	*Rootwad*			
10	4+79	*Log Cross Vane*				38	15+30	*Rootwad*			
11	5+26	*Boulder Cross Vane*				39	15+56	*Log Cross Vane*			
12	5+77	*Boulder Cross Vane*				40	15+60	*Log Cross Vane*			
13	5+97	*Lunker*				41	16+11	*Boulder Cross Vane*			
14	6+25	*Boulder Cross Vane*				42	16+62	*Log Cross Vane*			
15	6+74	*Boulder Cross Vane*				43	17+13	*Boulder Cross Vane*			
16	7+23	*Boulder Cross Vane*				44	17+63	*Boulder Cross Vane*			
17	7+72	*Log Cross Vane*				45	17+75	*Lunker*			
18	8+20	*Boulder Cross Vane*				46	18+15	*Boulder Cross Vane*			
19	8+35	*Rootwad*				47	18+66	*Boulder Cross Vane*			
20	8+43	*Rootwad*				48	19+55	*Boulder J-Hook Vane*			
21	8+51	*Rootwad*				49	19+73	*Lunker*			
22	8+69	*Boulder Cross Vane*				50	19+77	*Boulder Cross Vane*			
23	9+17	*Boulder Cross Vane*				51	20+19	*Boulder Cross Vane*			
24	9+47	*Boulder Cross Vane*				52	20+70	*Log Cross Vane*			
25	10+15	*Boulder Cross Vane*				53	21+21	*Boulder Cross Vane*			
26	10+84	*Boulder Cross Vane*				54	21+72	*Boulder Cross Vane*			
27	10+84	*Lunker*				55	22+23	*Log Cross Vane*			
28	11+12	*Boulder Cross Vane*				56	22+51	*Boulder J-Hook Vane*			

SEED MIX TABLE

STREAMBANK AND WETLAND SEED MIX (ZONE 1)

COMMON NAME	SCIENTIFIC NAME	PLANTING RATE (LBS. PLS PER ACRE)	AREA (ACRES)	TOTAL (LBS.)
RIVERBANK WILD RYE	*Elymus riparius*	5	0.5	2.5
WILD RYE	*Elymus Virginicus*	10	0.5	5
SOFT RUSH	*Juncus effusus*	2.5	0.5	1.25
SWITCHGRASS	*Panicum virgatum*	15	0.5	7.5
SEDGES	*Carex spp.*	2.5	0.5	1.25
			TOTAL	17.5

STANDARD SEED MIX (ZONE 2)

COMMON NAME	SCIENTIFIC NAME	PLANTING RATE (LBS. PLS PER ACRE)	AREA (ACRES)	TOTAL (LBS.)
BROWN-EYED SUSAN	*Rudbeckia triloba*	5	3.7	18.5
BIG BLUESTEM	*Andropogon gerardi*	5	3.7	18.5
AMERICAN BELLFLOWER	*Campanula americana*	10	3.7	37
SWITCHGRASS	*Panicum virgatum*	15	3.7	55.5
			TOTAL	129.5

TEMPORARY SEED MIX

COMMON NAME	SCIENTIFIC NAME	PLANTING RATE (LBS. PLS PER ACRE)	AREA (ACRES)	TOTAL (LBS.)
ANNUAL RYE	*Secale cereale*	10	5	50
WILD RYE	*Elymus virginicus*	10	5	50
			TOTAL	100

PLANTING TABLE

	COMMON NAME	SCIENTIFIC NAME	STRATUM	SPACING (FT)	PLANTING TYPE	STEM/ACRE	AREA (ACRES)	COMPOSITION (%)	TOTAL STEMS
ZONE 1	RIVER CANE	*Arundinaria gigantea*	Understory Shrub	3X3	LIVE STAKE	4840	0.78	25	944
	BUTTONBUSH	*Cephalanthus occidentalis*	Understory Shrub	3X3	LIVE STAKE	4840	0.78	25	944
	SILKY DOGWOOD	*Cornus amomum*	Understory Shrub	3X3	LIVE STAKE	4840	0.78	25	944
	AMERICAN ELDER	*Sambucus canadensis*	Understory Shrub	3X3	LIVE STAKE	4840	0.78	25	944
								Total	3775
ZONE 2	SWAMP CHESTNUT OAK	*Quercus michauxii*	Overstory Tree	10X10	BARE ROOT	400	3.7	10	148
	SHINGLE OAK	*Quercus imbricaria*	Overstory Tree	10X10	BARE ROOT	400	3.7	15	222
	NORTHERN RED OAK	*Quercus rubra*	Overstory Tree	10X10	BARE ROOT	400	3.7	10	148
	BLACK WALNUT	*Juglans nigra*	Overstory Tree	10X10	BARE ROOT	400	3.7	10	148
	PIN OAK	*Quercus palustris*	Overstory Tree	10X10	BARE ROOT	400	3.7	10	148
	YELLOW POPLAR	*Liriodendron tulipifera*	Overstory Tree	10X10	BARE ROOT	400	3.7	15	222
	AMERICAN ELM	*Ulmus americana*	Overstory Tree	10X10	BARE ROOT	400	3.7	5	74
	SPICEBUSH	*Lindera benzoin*	Understory Shrub	10X10	BARE ROOT	400	3.7	5	74
	WINTERBERRY	*Ilex verticillata*	Understory Shrub	10X10	BARE ROOT	400	3.7	5	74
	SYCAMORE	*Platanus occidentalis*	Overstory Tree	10X10	BARE ROOT	400	3.7	5	74
	GREEN ASH	*Fraxinus pennsylvanica*	Overstory Tree	10X10	BARE ROOT	400	3.7	5	74
	AMERICAN ELDER	*Sambucus canadensis*	Understory Shrub	10X10	BARE ROOT	400	3.7	5	74

PHASE B (50%) SUBMITTAL

REVISIONS	DATE
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CRANES NEST CREEK RESTORATION PROJECT

GENERAL NOTES

AS BUILT DATE

DRAWN BY: JCD, BJB

CHECKED BY: BJB

AGE FILE NO.

GRANT

DATE: MAY 11, 2009

DRAWING NO. C-2

COMMONWEALTH OF KENTUCKY
FINANCE AND ADMINISTRATION CABINET
DEPARTMENT OF PARKS
FRANKFORT, KENTUCKY

BEAVER CREEK HYDROLOGY, LLC
100 MISSION COURT, SUITE 100
FRANKLIN, TENNESSEE 37067
PHONE: 615-794-7771

REMARKED DRY OF BRIDGE

FOR INTENT ONLY

ENGR. FILE NO. 00010000

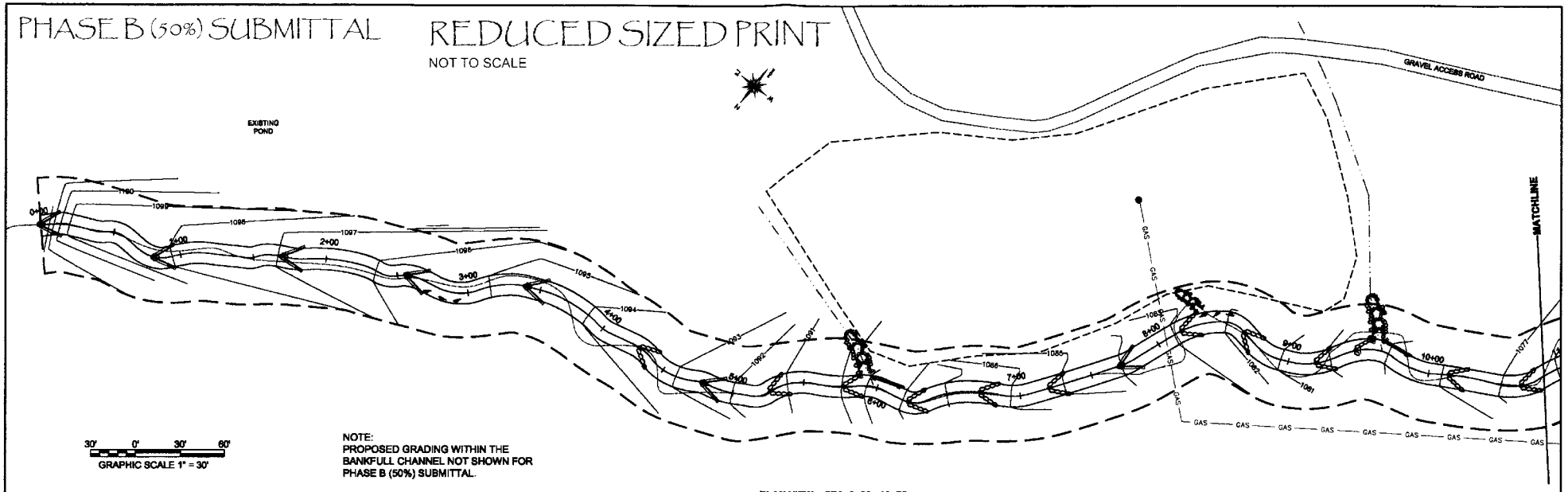
AGENCY AUTHORIZED AGENT — APPROVED FOR PRELIMINARY CONCEPT ONLY — DATE

DIVISION OF ENGINEERING — APPROVED FOR PRELIMINARY CONCEPT ONLY — DATE

PHASE B (50%) SUBMITTAL

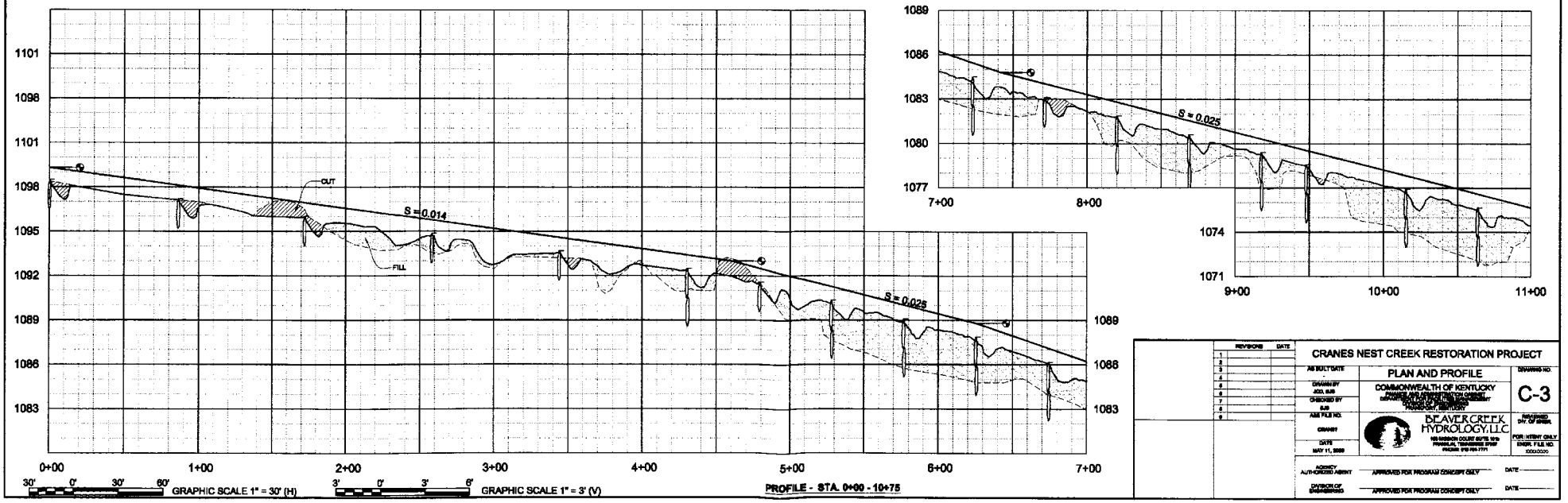
REDUCED SIZED PRINT

NOT TO SCALE



NOTE:
PROPOSED GRADING WITHIN THE BANKFULL CHANNEL NOT SHOWN FOR PHASE B (50%) SUBMITTAL.

PLAN VIEW - STA. 0+00 - 10+75



PROFILE - STA. 0+00 - 10+75

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CRANES NEST CREEK RESTORATION PROJECT

PLAN AND PROFILE

COMMONWEALTH OF KENTUCKY
DEPARTMENT FOR ENVIRONMENTAL PROTECTION
DIVISION OF WATER
FRANKFORT, KENTUCKY

BEAVER CREEK HYDROLOGY, L.L.C.

DRAWING NO.
C-3

AS BUILT DATE

DRAWN BY
ADD, BJB

CHECKED BY
BJB

A&E FILE NO.

DRAWN

DATE
MAY 11, 2009

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DIV. OF WATER

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DIVISION OF ENGINEERING — APPROVED FOR PROGRAM CONCEPT ONLY — DATE

PHASE B (50%) SUBMITTAL

REDUCED SIZED PRINT

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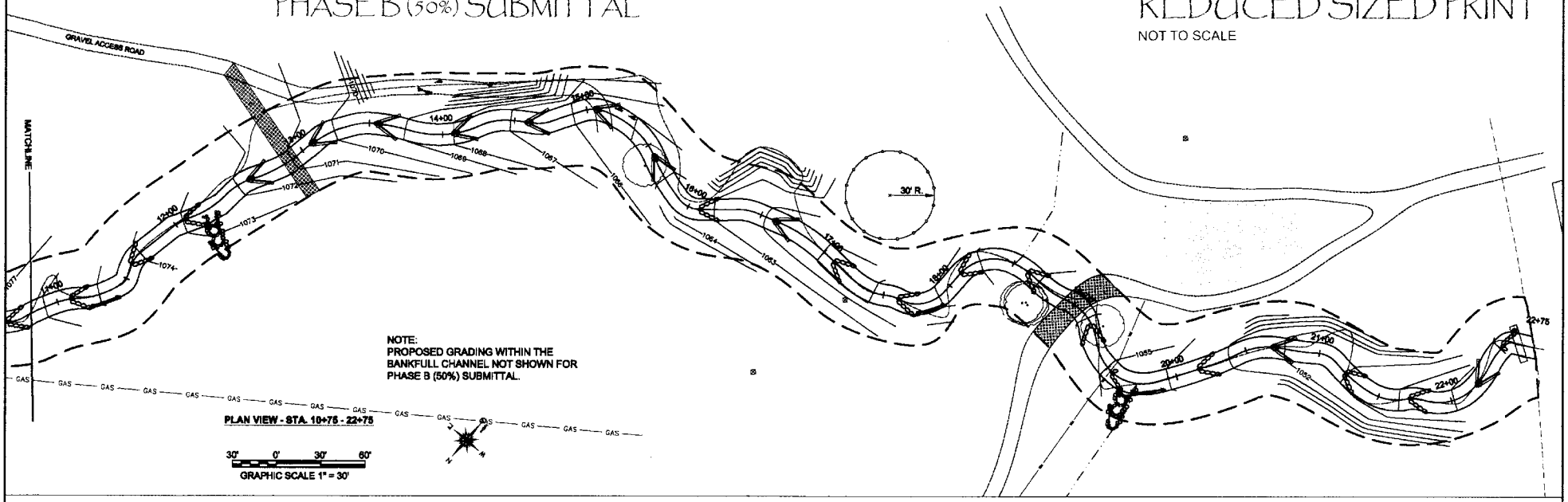

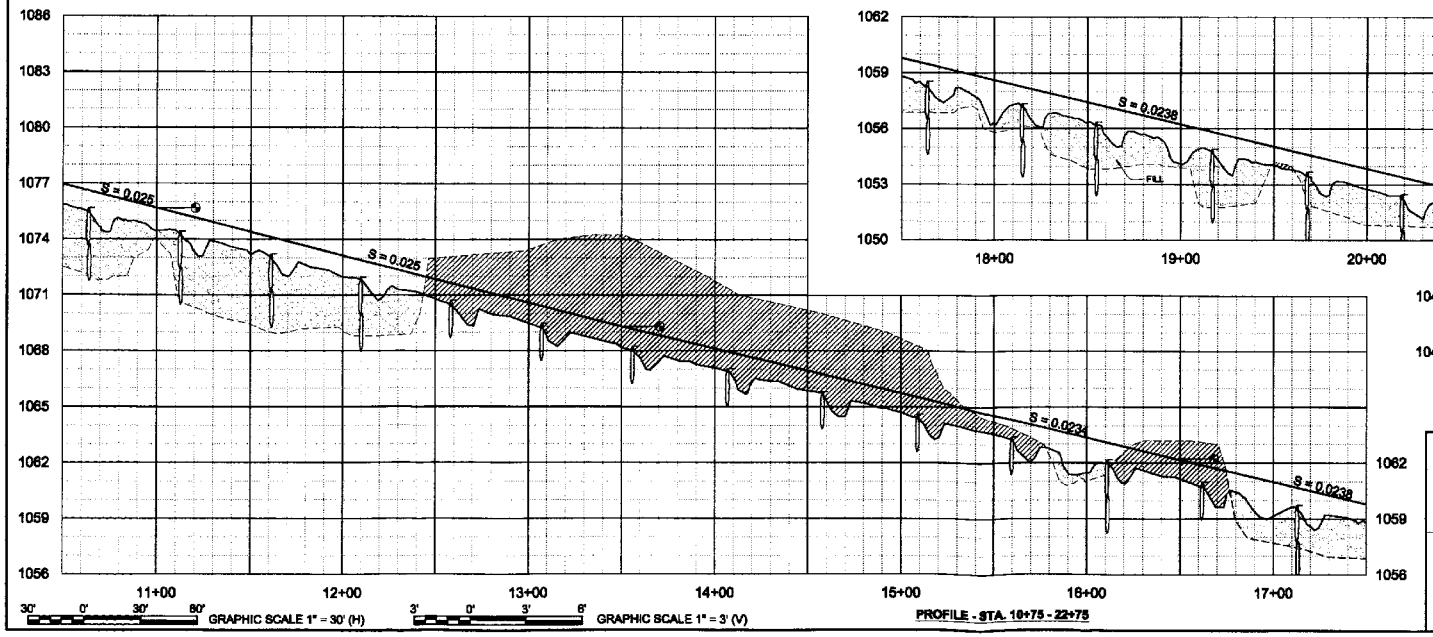

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CRANES NEST CREEK RESTORATION PROJECT

PLAN AND PROFILE

AS BUILT DATE

DRAWN BY: JCD, BJS

CHECKED BY: BJS

ABE FILE NO.: CRANE1

DATE: MAY 11, 2009

COMMONWEALTH OF KENTUCKY
ENERGY AND ENVIRONMENT CABINET
DEPARTMENT OF NATURAL RESOURCES
DIVISION OF FORESTRY
FRANKFORT, KENTUCKY

BEAVER CREEK HYDROLOGY, LLC.
109 MANNON COURT SUITE 205
FRANKLIN, TENNESSEE 37067
PHONE: (615) 435-7771

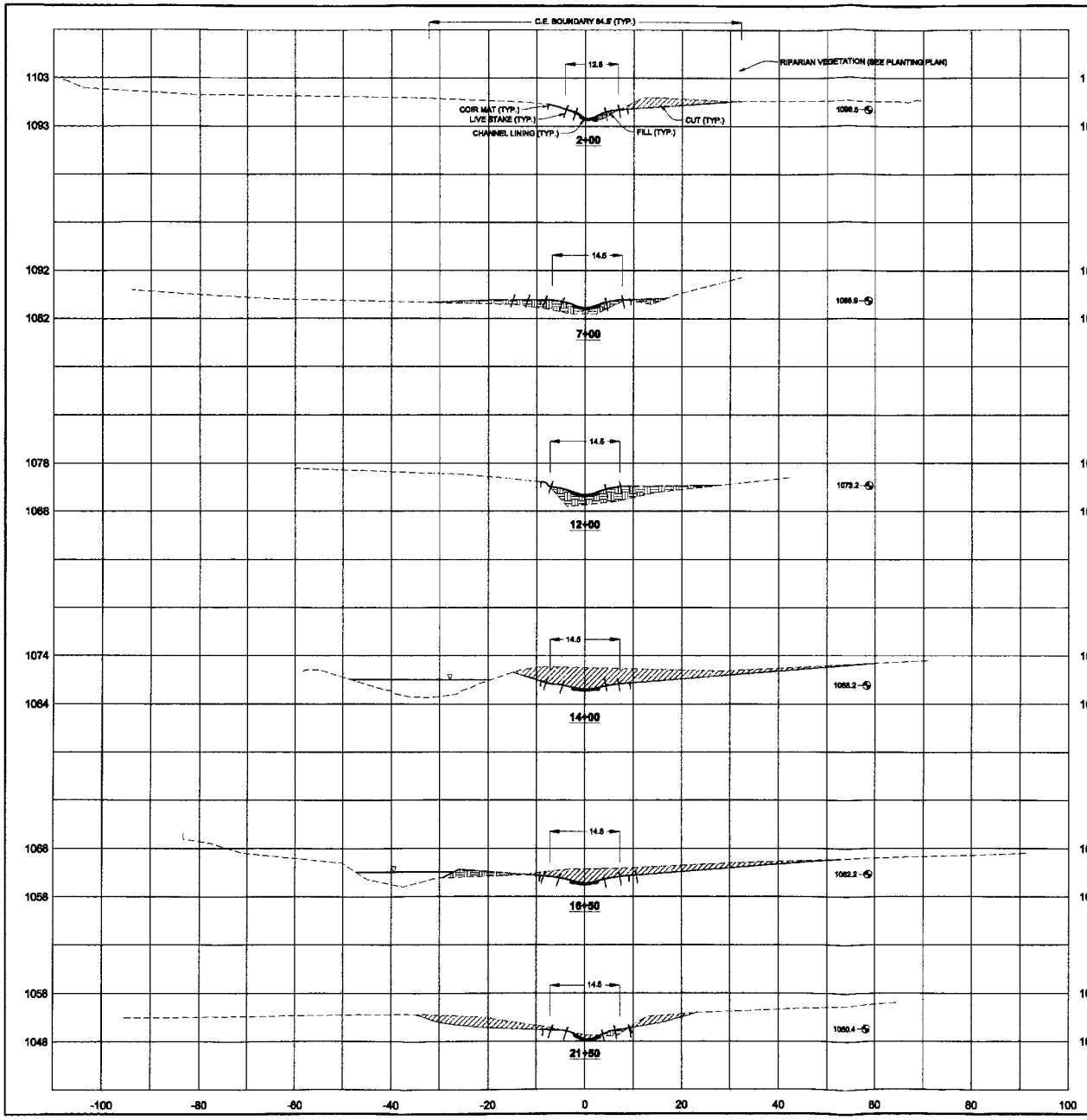
DRAWING NO.: C-4

SURVEYING DIV. OF ENGR.

FOR INTENT ONLY
ENGR. FILE NO.: KY2010002

AGENCY AUTHORIZED AGENT — APPROVED FOR PROGRAM CONCEPT ONLY — DATE

DIVISION OF ENGINEERING — APPROVED FOR PROGRAM CONCEPT ONLY — DATE



PHASE B (50%) SUBMITTAL

REDUCED SIZED PRINT

NOT TO SCALE

REVISIONS	DATE
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CRANES NEST CREEK RESTORATION PROJECT

TYPICAL SECTIONS

DRAWING NO. C-5

AS BUILT DATE

DRAWN BY JCD, BJS

CHECKED BY BJS

A&E FILE NO. CRAN01

DATE MAY 11, 2009

COMMONWEALTH OF KENTUCKY
FINANCE AND ADMINISTRATION CABINET
DEPARTMENT OF FISH AND WILDLIFE RESOURCES
DIVISION OF FISHERIES
FRANKFORT, KENTUCKY

BEAVER CREEK HYDROLOGY, L.L.C.
100 MISSION COURT SUITE 101
FRANKLIN, TENNESSEE 37067
PHONE: 615-790-7771

APPROVED FOR PROGRAM CONCEPT ONLY

AGENCY AUTHORIZED AGENT — DATE

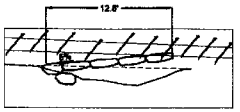
DIVISION OF ENGINEERING — DATE

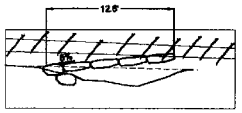
REVISED DIV. OF ENGR.

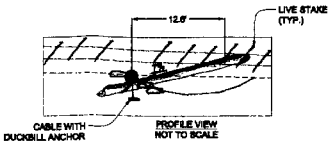
FOR INTENT ONLY

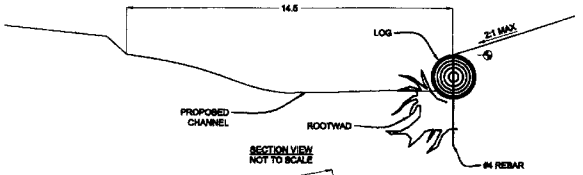
ENGR. FILE NO. XXXXXXXX

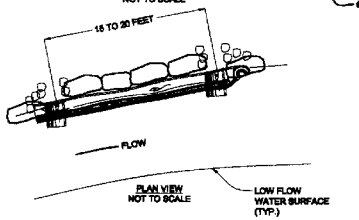
PHASE B (50%) SUBMITTAL



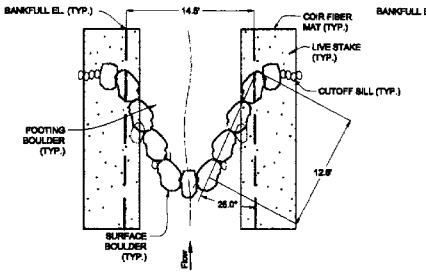


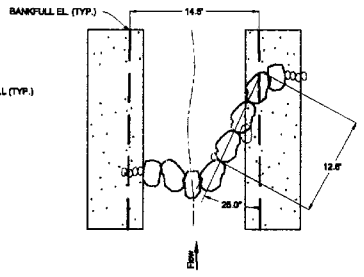


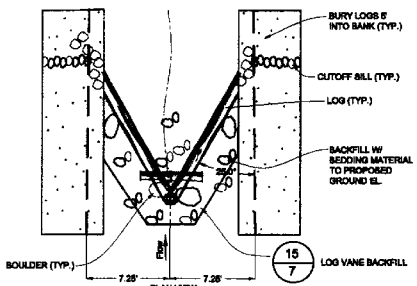


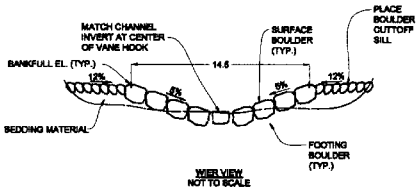


4/6 DETAIL - LUNKER STRUCTURE

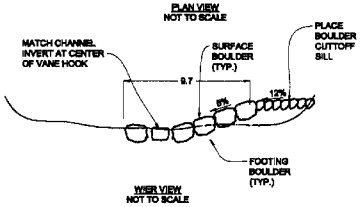




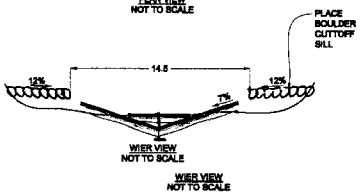




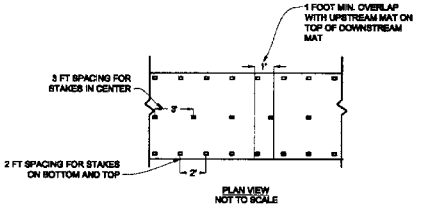
1/6 DETAIL - CROSS VANE

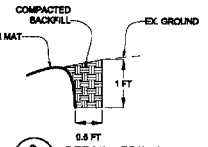


2/6 DETAIL - J-HOOK VANE

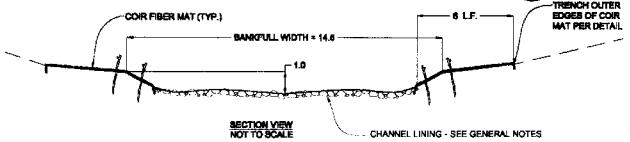


3/6 DETAIL - WEDGE VANE



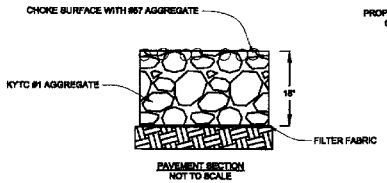


8/6 DETAIL - TRENCH

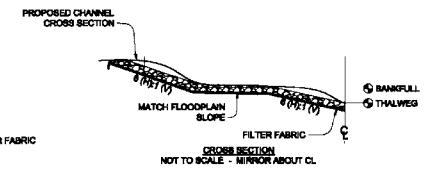


7/6 DETAIL - COIR MATTING

NOTES:
1. PLACE COIR MATTING ON ALL DISTURBED BANKS WITHIN THE BANKFUL CHANNEL.
2. MATTING SHALL BE INSTALLED PRIOR TO WATER BEING RELEASED INTO THE CHANNEL.



NOTES:
1. PLAN VIEW SHOWN IN DRAWINGS FOR EACH CROSSING.



5/6 DETAIL - LOW WATER FORD

6/6 DETAIL - BOULDER

N.T.S.

NOTE:
1. SURFACE BOULDERS - USE 12" X 24" X 36" LIMESTONE OR DOLOMITE BOULDERS.
2. FOOTING BOULDERS - USE 12" X 24" X 36" LIMESTONE OR DOLOMITE BOULDERS. FOOTING BOULDERS ARE NOT REQUIRED WHEN COMPETENT BEDROCK IS PRESENT.

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CRANES NEST CREEK RESTORATION PROJECT

AS BUILT DATE

STREAM RESTORATION DETAILS

DRAWING NO. C-6

DRAWN BY: ADD, BJS

CHECKED BY: BJS

COMMONWEALTH OF KENTUCKY
ENERGY AND ENVIRONMENT CABINET
DEPARTMENT FOR ENVIRONMENTAL PROTECTION
DIVISION OF WATER
FRANKFORT, KENTUCKY

AGE FILE NO.

DRAWN

BEAVER CREEK HYDROLOGY, L.L.C.

RECEIVED DIV. OF WATER

DATE: MAY 11, 2009

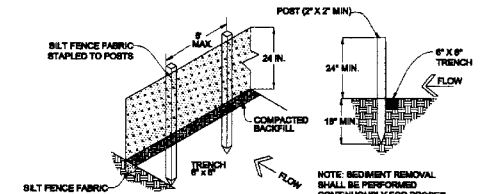
FOR INTENT ONLY

ENGR. FILE NO. XXXX2000

AGENCY AUTHORIZED AGENT — APPROVED FOR PRELIMINARY CONCEPT ONLY — DATE

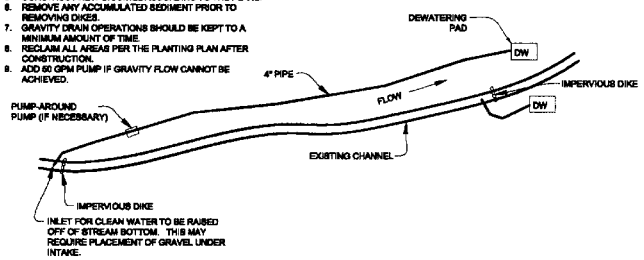
DIVISION OF ENGINEERING — APPROVED FOR PRELIMINARY CONCEPT ONLY — DATE

PHASE B (50%) SUBMITTAL

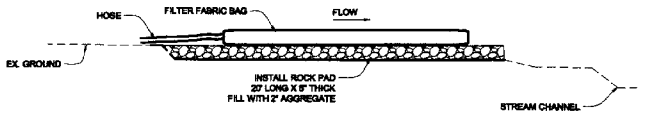


9/7 DETAIL - SILTATION FENCE
N.T.S.

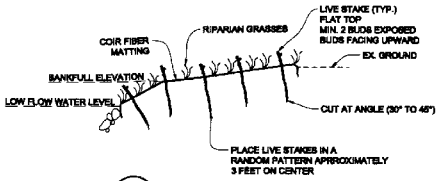
NOTES:
1. INSTALL DEWATERING BASINS
2. INSTALL PIPE FOR GRAVITY DRAIN
3. PLACE UPSTREAM IMPERVIOUS DIKE AND PREPARE INLET OF PIPE.
4. PREPARE DOWNSTREAM GRAVITY FEED FOR A DEWATERING OPERATION.
5. CONSTRUCT NEW CHANNEL ACCORDING TO THE PLANS.
6. REMOVE ANY ACCUMULATED SEDIMENT PRIOR TO REMOVING DIKES.
7. GRAVITY DRAIN OPERATIONS SHOULD BE KEPT TO A MINIMUM AMOUNT OF TIME.
8. RECLAIM ALL AREAS PER THE PLANTING PLAN AFTER CONSTRUCTION.
9. ADD 50 GPM PUMP IF GRAVITY FLOW CANNOT BE ACHIEVED.



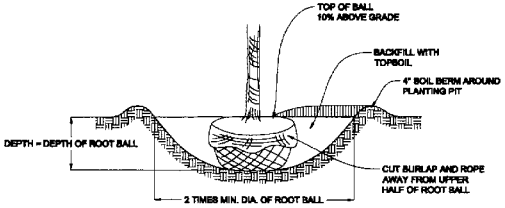
11/7 DETAIL - PUMP-AROUND DIVERSION OPERATION



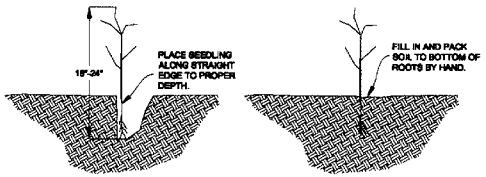
13/7 DETAIL - DEWATERING PAD
N.T.S.



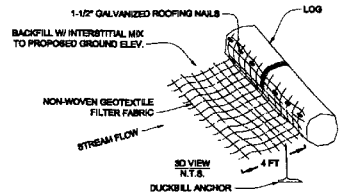
10/7 DETAIL - PLANTING OF LIVE STAKES
N.T.S.



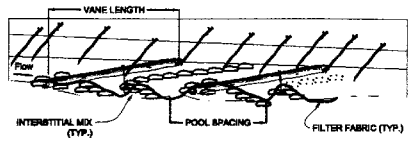
12/7 DETAIL - PLANTING OF SHRUBS/TREES
N.T.S.

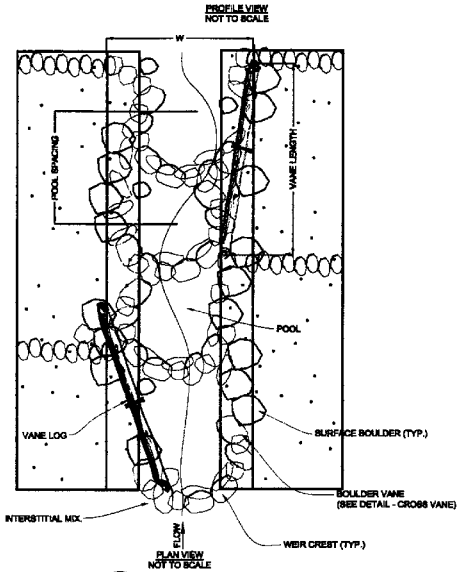


14/7 DETAIL - PLANTING OF BARE ROOT SEEDLING
N.T.S.

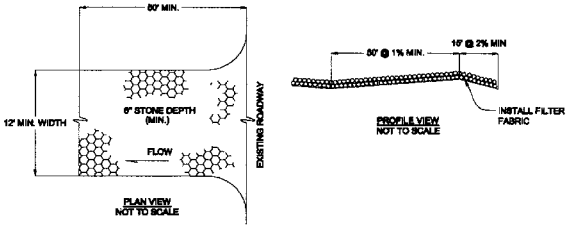


15/7 DETAIL - LOG VANE BACKFILL
N.T.S.





16/7 DETAIL - STEP POOLS
N.T.S.



17/7 DETAIL - STABILIZED CONSTRUCTION ENTRANCE
N.T.S.

REVISIONS	DATE
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CRANES NEST CREEK RESTORATION PROJECT

AS BUILT DATE
DRAWN BY: JDO, SJS
CHECKED BY: SJS
AGS FILE NO.
DRAWN:
DATE: MAY 11, 2009

STREAM RESTORATION DETAILS

COMMONWEALTH OF KENTUCKY
FINANCE AND ADMINISTRATION CABINET
DEPARTMENT OF PROCUREMENT
DIVISION OF PROCUREMENT
FRANKFORT, KENTUCKY

DRAWING NO: C-7

BEAVER CREEK HYDROLOGY, LLC
109 BRIDGE COURT SUITE 101
FRANKLIN, TENNESSEE 37064
PHONE: 615-790-7771

APPROVED BY DIV. OF ENGR.

FOR INTENT ONLY
ENGR. FILE NO.
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AGENCY AUTHORIZED AGENT — APPROVED FOR PROGRAM CONCEPT ONLY — DATE
DIVISION OF ENGINEERING — APPROVED FOR PROGRAM CONCEPT ONLY — DATE